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IS 5114 (1969): Specification for Reflectorized Signs for Mines [MED 8: Mining Techniques and Equipment]



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*"Reaffirmed 1983"*

**IS : 5114 - 1969**  
**( Reaffirmed 1977 )**

*Indian Standard*

**SPECIFICATION FOR  
REFLECTORIZED SIGNS FOR MINES**

**( First Reprint MARCH 1983 )**

UDC 622.86 : 628.975



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**INDIAN STANDARDS INSTITUTION**  
**MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG**  
**NEW DELHI 110002**

# *Indian Standard*

## SPECIFICATION FOR REFLECTORIZED SIGNS FOR MINES

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# *Indian Standard*

## SPECIFICATION FOR REFLECTORIZED SIGNS FOR MINES

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 18 April 1969, after the draft finalized by the Mining Sectional Committee had been approved by the Mechanical Engineering Division Council.

**0.2** Below ground and on the surface, signs form an effective means for directing attention to potentially dangerous conditions or hazards where caution should be exercised, for indicating the location of safety equipment and facilities, and for controlling and directing traffic.

**0.3** Care should be exercised in locating mining signs, and the underlying reason for their installation should be self-evident or made clear to all personnel concerned. A sign will not be observed if placed much above or below eye level, nor if there is insufficient colour contrast with its immediate surroundings. The real purpose of a sign is to awaken a spontaneous response even before the message has been read, and the colour combinations of the signs described in the code have been selected to that end.

**0.4** It should be clearly understood that provision of danger and warning signs in and about mines can be no more than an adjunct to safety, and that as soon as the hazard has been eliminated the relevant sign should be removed.

**0.5** This standard seeks to establish uniformity in the shape, colour scheme, dimensions and manner of use of reflectORIZED signs for particular locations and conditions in and about mines and tunnels. In this standard light-weight double-sided reflectORIZED safety sign having a bold green arrow on a white background for the exclusive use of mine rescue team is introduced its purpose being to supersede the use of the white chalk, but not the life line, commonly used by such teams. ReflectORIZED signs are intended to be conspicuous when viewed at night under the illumination of cap lamps or vehicle headlight. Under normal conditions of reflector position and of distribution of head lamp intensity, the luminance of the ideal reflecting surface should be high enough at distance between 15 metres and 50 metres, so as to be visible.

**0.6** In the preparation of this standard considerable assistance has been derived from the following standards:

A.S. No. CM 3-1960 Design and Use of ReflectORIZED Signs for Mines. Standards Association of Australia.

SAA Int 354-1955 Retro-reflecting Materials for Road Signs and Vehicles. Standards Association of Australia.

**0.7** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard applies to the design, construction and manner of erection of reflectorized accident-prevention and guide signs for use in and about mines. It defines as far as practicable, the types of signs to be used to indicate particular hazards which may cause accidents where such hazards cannot physically be removed; directions to be followed, the location of exits and safety and fire protection equipment, and information relative to safe practices.

**1.2** The code does not apply to information signs of a general nature, such as plant bulletin boards, safety posters, and the like. It is recommended, however, that such signs should not display a predominance of any of the accepted safety colours, namely, red, yellow and green.

**1.3** The code makes no recommendation as to when reflectorized signs should be used in preference to non-reflecting signs.

**1.4 Application** — The code shall not be applied in a manner conflicting with the generally accepted standards or regulations relating to the use of colour for making of physical hazards and certain industrial plant and equipment.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Angle of Incidence** — The angle which the incident light ray makes with the normal to the surface of the reflecting material.

**2.2 Angle of Observation** — The angle which a light ray reflected towards the observer makes with the incident ray.

**2.3 Illuminant A** — A gas-filled incandescent tungsten filament lamp of colour temperature 2 854°K.

**2.4 Reflectance** — The ratio of the luminance of a surface under given conditions of illumination and observation to the luminance of a thick,

\*Rules for rounding off numerical values (*revised*).

freshly, prepared layer of magnesium oxide illuminated and viewed in the same manner.

**2.5 Sign** — Any surface bearing letters, figures or symbols prepared for the purpose of instructing, warning or guiding employees and members of the public who may be exposed to physical hazards, or be subject to regulations associated with industrial operations in and about mines and tunnels.

### **3. REFLECTORIZATION**

**3.0** The orientation of reflectorized signs is important to ensure maximum efficiency of the reflecting medium and final placing of the signs shall be checked in darkness using illumination from cap lamps or vehicle as appropriate.

**3.1** The reflecting material shall comply with the requirements as given in Appendix A.

## **4. SIGN**

### **4.1 Classes of Sign**

**4.1.1** Signs shall be classified as follows:

- a) Danger signs — Class A,
- b) Caution signs — Class B,
- c) Safety instruction signs — Class C,
- d) Rescue markers — Class C,
- e) Fire fighting signs — Class D,
- f) Direction signs — Class E,
- g) Traffic signs — Class F, and
- h) Information signs — Class G.

**4.1.2** Typical examples of the type of wording to be used on various classes of sign are given in Appendix B.

### **4.2 Use of Signs**

**4.2.1** The various classes of sign shall be used as follows:

- a) *Danger signs* — to indicate places where an actual hazard exists;
- b) *Caution signs* — to indicate places where care is necessary, or to prevent unsafe practices;
- c) *Safety instruction signs* — to indicate the location of safety service and, where the need exists, to give general instructions and suggestions relative to safety measures;



- d) *Rescue markers* — by mine rescue teams as additional safety device to life line;
- e) *Fire fighting signs* — to indicate the location of fire fighting equipment and fire alarms, and to instruct in the use of such equipment;
- f) *Direction signs* — to indicate exits, escape-ways and the direction leading to safety equipment, safety services, toilets, etc;
- g) *Traffic signs* — to indicate to drivers and pedestrians instructions and warning relating to safe movement of traffic; and
- h) *Information signs* — to indicate information of a specific nature.

**4.2.2** *Constancy of Sign Design* — There shall be no variation in the type of design of the signs used to indicate similar hazards, safety instructions and equipment or directions to be followed.

**4.2.3** Indiscriminate use of signs, especially 'Danger' and 'Caution' and failure to remove them promptly when they have fulfilled their purpose, may induce disrespect for all signs. For example, the sign, 'Danger-Explosives', should be removed immediately the explosives have been removed, and the sign, 'Caution Beware of Traffic', should be removed when traffic no longer passes that point.

### 4.3 Sign Colours

**4.3.1** Certain broad colour divisions are reserved for particular sign classes as given below, and selected colours within those divisions are specified for those sign classes. Neither of those colours within the broad divisions shall be incorporated in any other type of sign except as provided in 4.4.4.

**4.3.2** The allotted colour of a sign shall be added in sufficient quantity so as to make that colour predominate the sign. The actual colour used shall conform to the following specified Indian Standard colours as given in IS : 5-1961\*:

- a) Colour No. 104, Azure blue;
- b) Colour No. 218, Grass green;
- c) Colour No. 356, Golden yellow; and
- d) Colour No. 537, Signal red.

### 4.4 Sign Design

**4.4.1** The type and size of lettering used for the sign wording and the arrangement of wording shall be such as to give good legibility and balance, as given in Appendix C.

\*Colours for ready mixed paints (second revision).

4.4.2 The standard dimensions for mining signs as listed in Table 1, are recommended. A tolerance of  $\pm 3$  mm shall be permitted on all of the listed dimensions.

4.4.3 Where owing to site conditions larger or smaller than the standard signs are considered necessary, such signs should wherever possible retain the general shape and colour scheme, and the legend or symbol of the standard signs.

NOTE — The design for ' Danger ' and ' Caution ' signs are of distinctive patterns in order that they will be readily recognised by all concerned including those who are colour blind.

4.4.4 The design details of each class of sign shall be as given below:

- a) *Danger signs* — A white background shall cover the face of the sign. The word ' DANGER ' shall appear in *white* letters on a *red* oval. The red oval shall be placed on a black rectangular panel with a *white* line surrounding the oval and separating it from the black panel. The ' DANGER ' panel should be placed at the top of sign. The sign message should be placed below the ' DANGER ' panel in *black* letters on the white background.
- b) *Caution signs* — Caution signs shall have yellow background and border with the word ' CAUTION ' in *yellow* letters on a *black* rectangular panel. The ' CAUTION ' panel shall be placed at the top of the sign with the message below in black letters on the yellow background.
- c) *Safety instruction signs* — Safety instruction signs shall have a *green* background with the sign message in *white* letters.
- d) *Rescue markers* — Rescue markers shall have a *white* background and a bold *green* arrow. Rescue markers should be double-sided with both arrows pointing in the same direction.
- e) *Fire protection signs* — Fire protection signs shall have a *red* background with the sign message in *white* letters.

The triangular-shaped fire fighting equipment signs shall also have a distinctive coloured disc ( with a narrow white border ) in the centre to identify the particular equipment as follows:

- 1) A red disc for water-type extinguishers.
- 2) A blue disc for foam-type extinguishers.
- 3) A yellow disc for carbon tetrachloride extinguishers.
- 4) Half red half blue disc for dry powder type fire extinguisher.
- 5) Half blue half yellow disc for carbon dioxide type fire extinguisher.

- 6) Half red half yellow disc for multipurpose dry powder type fire extinguisher.

NOTE — Carbon tetrachloride extinguishers shall not be used below ground, and should not be used in confined spaces above ground.

- f) *Direction signs* — The background colour of a direction signs shall be appropriate to the service to which the sign relates; for example, a fire emergency exit direction sign should have a background bearing the words 'EMERGENCY EXIT' in *white* letters.
- g) *Traffic signs* — The shape and colour of the mining traffic signs shall comply with the requirements of Table 1 as appropriate to the type and purpose of the particular sign.
- h) *Information signs* — Information signs shall have a *blue* background with a sign message in *white* letters.

## 4.5 Sign Construction, Erection and Removal

**4.5.1 Preprepared Signs** — Signs which are prepared for subsequent erection at the selected location (that is, signs other than those painted on existing surfaces), shall be so constructed and erected that they will not themselves create a hazard; all such signs shall be of rigid construction.

**4.5.2 Background Colour** — Where signs are located on walls or convenient structures instead of on posts, the background colour shall contrast with the predominant colours on the signs.

## 4.6 Sign Location

**4.6.0** The selection of suitable locations for signs is important in order that the messages on the signs will not only be legible but also clearly visible to all concerned. Responsibility for the correct placement of signs shall be rested in a competent official.

**4.6.1 Height** — Signs shall be placed at heights slightly above eye-level unless a particular message or location makes some other height advisable.

**4.6.2 Projecting Signs** — All signs shall be so located that they do not themselves create a hazard, for example, signs projecting into passways shall be placed at heights where persons will not strike against them.

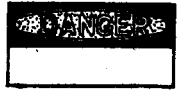





**4.6.3** Ordinarily, signs shall not be placed on moving objects, such as doors, if any change in position of the objects tends to obscure the signs from view.







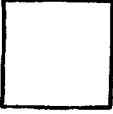

### 4.6.4 Sign Distance from Hazard

**4.6.4.1** 'Danger' and 'Caution' signs shall be placed sufficiently before a hazard to allow all concerned ample time after first sighting the signs to heed their warnings.

TABLE 1 DESIGN FOR REFLECTORIZED SIGNS FOR MINES

( Clauses 4.4.2 and 4.4.4 )

CLASS	SHAPE	COLOUR SCHEME		SIGNIFICANCE OF SIGN	STANDARD SIZE, mm	
		Background	Legend or Symbol		Large	Small
A		Red, black and white	Black on white	Danger warning	460 × 230	230 × 115
B		Yellow and black	Black on yellow	Caution	460 × 230	230 × 115
C*		Green	White	Safety instruction	460 × 230	230 × 115
C*		White	Green	Mine rescue work only	—	230 × 115
D		Red	White	Fire protection and equipment	460 × 230	230 × 115
D		Red	White with coloured disc	Fire extinguishers	300 Base and height	

E		White on black, black on white (or as appropriate to the particular service)		Direction	460 × 230	230 × 115
E		White	—	Supplementary direction for '2nd egress'	—	100 × 25
F		Red	White	Regulatory stop	300 × 300	—
F		White	Black	All other regulatory	230 × 300	—
F		Black	White cross	Railway crossing	300 × 230	—
F		Black	Red cross	Rear of train	300 × 230	—
F		Yellow	Black	Warning	300 × 300	—
G		Blue	White	Information	460 × 230	230 × 115

NOTE — All signs are single-sided except the Mine Rescue arrow. Where double-sided signs are required this should be stated with the order.

\*First Aid Signs will be indicated by a 'Red Cross' only.

4.6.4.2 The distance between individual signs and hazards to which they relate will vary with the site conditions, for example, signs warning against the touching of switches or other equipment shall be placed close to the equipment, whereas signs used in old workings or on haulage roads shall be placed sufficiently before the danger zone to provide adequate warning.

## 5. INSTRUCTION OF PERSONNEL

5.0 Adequate instructions in the meaning and use of signs should be given to all employees, particularly those who are directly concerned in the precautions which should be observed.

5.1 When it is proposed to post a new sign or change the location of an existing sign, it is desirable that the employees be informed beforehand and an explanation given for the introduction of the new sign or the change in location of the existing one.

## 6. SIGN MAINTENANCE

6.1 To be effective, signs should be inspected and cleaned regularly, and maintained in good condition.

# APPENDIX A

( Clause 3.1 )

## REQUIREMENTS FOR RETRO-REFLECTING MATERIALS

### A-1. TYPE

A-1.1 Retro-reflecting materials are of two types:

- a) *Type A* — For use where efficient reflection is not required for angles, between the incident beam and the normal to the reflecting surface, greater than 20°.
- b) *Type B* — For the use where efficient reflection is required for angles greater than 20°.

### A-2. COLOUR

A-2.1 When viewed under diffused daylight, the colours of reflecting material shall be as defined in IS : 5-1961\*, colour No. 356-golden yellow,

\*Colours for ready mixed paints ( *second revision* ).

No. 537-signal red, and No. 218-grass green, as appropriate. When viewed under headlamp illumination at an angle of incidence of  $5^\circ$ , the colours of the reflecting materials shall also be readily identifiable with the above colours.

### A-3. OPTICAL PROPERTIES

**A-3.1** The reflecting material shall have the following optical properties.

**A-3.1.1** *Type A* — For light from illuminant A incident at angles of  $5^\circ$  and  $20^\circ$ , the mean reflectance averaged over all orientations of the reflected ray around the incident ray, the angle of observation being  $0.5^\circ$ , shall in each case be not less than the values listed in Table 2.

**A-3.1.2** *Type B* — For light from illuminant A incident at angles of  $5^\circ$ ,  $20^\circ$  and  $60^\circ$ , the mean reflectance averaged over orientations of the reflected ray around the incident ray, the angle of observation being  $0.5^\circ$ , shall in each case be not less than the values listed in Table 2.

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**TABLE 2 MINIMUM REFLECTANCES**

COLOUR	REFLECTANCE
White	9.0
Yellow	9.0
Red	4.5
Green	4.5

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### A-4. DURABILITY

**A-4.1** After three years of exposure to any naturally occurring service conditions, the reflectance shall be not less than two-thirds of the values listed in Table 2, the colours shall substantially satisfy the requirements of A-2 and all layers of the reflecting material shall still adhere firmly to the base.

## A P P E N D I X B

( Clause 4.1.2 )

### SIGN WORDING

**B-1.** The following examples are typical of the type of wording to be used on mining signs. For shape, colour scheme and dimensions, see Table 2.

*Class A — Danger Signs*

- DANGER — HIGH VOLTAGE ( or state voltage, for example, 3 000 volts )
- DANGER — LIVE WIRES
- DANGER — NO SMOKING
- DANGER — NO MATCHES
- DANGER — NO OPEN LIGHTS
- DANGER — NO ROAD AT FIRING TIME
- DANGER — KEEP AWAY
- DANGER — KEEP OFF
- DANGER — KEEP OUT
- DANGER — EXPLOSIVES

} — Add reason

*Class B — Caution Signs*

- CAUTION — LOW HEADROOM
- CAUTION — KEEP DOOR CLOSED ( Add reason )
- CAUTION — SPEED LIMIT km/h
- CAUTION — CLEARANCE METRES
- CAUTION — KEEP THIS SPACE CLEAR ( or WALKWAY, EXIT, etc, as appropriate )
- CAUTION — KEEP ROADWAY CLEAR
- CAUTION — OPERATORS OF THIS MACHINE SHALL WEAR CLOSE FITTING CLOTHING — NO GLOVES
- CAUTION — WATCH YOUR STEP
- CAUTION — BEWARE OF TRAFFIC
- CAUTION — PROTECT YOUR EYES — DO NOT WATCH WELDING
- CAUTION — WALK — DON'T RUN
- CAUTION — NARROW

*Class C — Safety Instruction Signs*

- FIRST AID
- STRETCHERS
- GAS MASKS

*Class D — Fire Equipment Signs*

- FIRE HOSE
- FIRE HYDRANT ( initial letters ' FH ' preferred )



**SAND — FOR FIRE ONLY  
FIRE EXTINGUISHERS FOR OIL FIRES**

*Class E — Direction Signs*

**EMERGENCY EXIT  
DETOUR — ROAD CLOSED  
SECOND EGRESS**

*Class F — Traffic Signs*

**STOP  
NO TURN  
KEEP LEFT  
ROAD CLOSED  
RAILWAY CROSSING  
CROSS ROAD  
'Y' JUNCTION  
STEEP GRADE**

*Class G — Information Signs*

**AIRWAY  
KEEP THIS AIRWAY CLEAR  
KEEP THIS PASSAGEWAY CLEAR  
PHONE**

## **A P P E N D I X C**

*( Clause 4.4.1 )*

### **SIGN LETTERING**

#### **C-1. TYPE OF LETTER**

**C-1.1** The vertical block type letter using full strokes shall be used because it is more easily read and requires less variations in the alphabet than most other types of letter faces.

#### **C-2. SIZE OF LETTER**

**C-2.1** The letter proportions for 25 mm high letters shall be as given in Table 3, other sizes will be proportional.

**TABLE 3 WIDTH OF LETTERS**

( Clause C-2.1 )

LETTER	WIDTH mm
W	28
B. C. D. G. K. O. P. Q. R. S. T. and X	19
A. M. V. Y. and Z	22+
H. N. U	17-
E. F. J and L	16+
1 and vertical strokes of all letters	5+

NOTE — '+' or '-' indicates that this width should only be slightly over or slightly under the measurement shown respectively.

**C-3. HEIGHT OF LETTERS**

**C-3.1** The height of lettering used should be as large as possible, consistent with good balance and legibility. Table 4 shows the maximum distance at which well proportional letters of different heights can be read by persons of *normal vision* under good *lighting* conditions. In view of the qualifications in the preceding sentence, it is evident that in many cases these sizes will have to be increased to give clear legibility.

**TABLE 4 HEIGHT OF LETTERS FOR LEGIBILITY**

HEIGHT OF LETTER mm	DISTANCE VISIBLE m
90	62 - 65
75	51 - 54
63	42 - 45
50	33 - 36
45	29 - 32
37	24 - 27
31	21 - 24
25	18.5 - 20
22	15 - 16.5
19	12 - 13.5
16	9 - 10.5
12	7.5 - 9
9	6 - 7.5
6	4.5 - 6

**C-4. LAYOUT AND SPACING**

**C-4.1** It is not possible to give definite recommendations as to how to layout the letters contained in a sign message in order to produce the best sign from the standard of balance and legibility. The layout can be decided only at the time the sign is being designed. However the spacing between letters is important. Letters shall never be crowded together, neither shall they be too widely spaced. The details for assistance in setting up well-balanced letter spacing are shown in Table 5. The spacings given are for 25 mm high letters; other sizes will be proportional.

**TABLE 5 SPACING OF LETTERS**

BETWEEN	SPACE
	mm
Vertical close, sided letters together, e.g. BC, NK	5
Open side next to closed vertical side, e.g. EB, FN	4
Open sides next to each other, e.g. ETY and ITT	2.5 at top
Spacing sides next to each other, e.g. WAYAY	5 at centre line
Spacing sides next to vertical side, e.g. AB, AJ	1.5
Overlapping horizontals, e.g. LT, LY	5 at top

( Continued from page 1 )

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# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS)

## Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

## INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31

Telegrams : Manaksanstha

### Regional Offices:

		Telephone
Western	: Novelty Chambers, Grant Road	BOMBAY 400007 37 07 29
Eastern	: 5 Chowringhee Approach	CALCUTTA 700072 27 50 90
Southern	: CIT Campus	MADRAS 600113 41 24 42
Northern	: B89, Phase VII	S. A. S. NAGAR (MOHALI) 160051

### Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	22 48 05
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 18
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
R 14 Yudhister Marg, C Scheme	JAIPUR 302005	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	4 72 92
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27